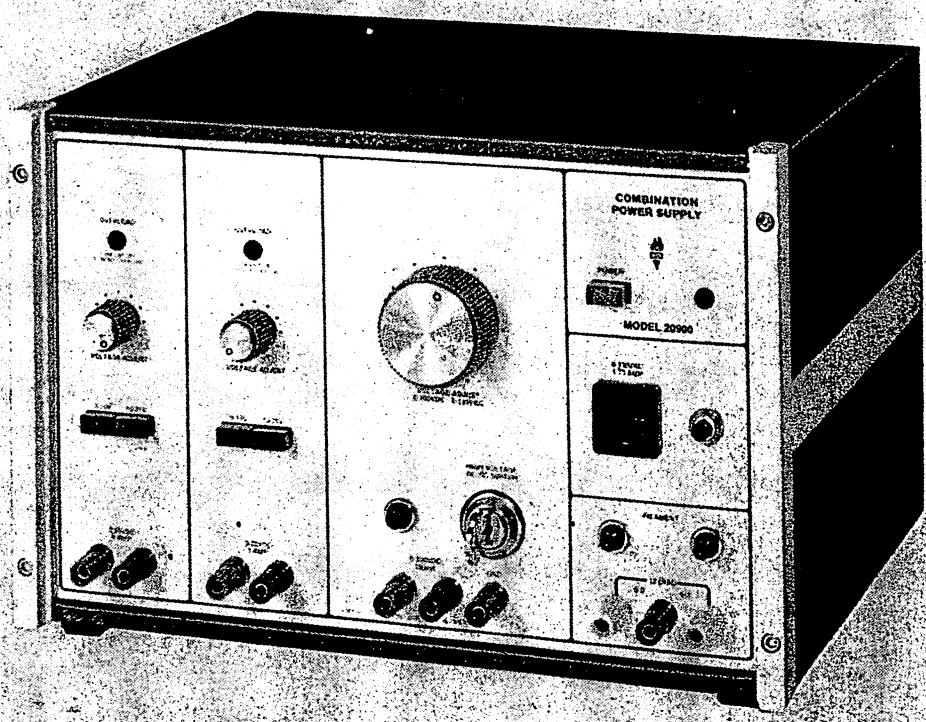
MAINTENANCE INFORMATION FOR THE

COMBINATION AC/DC POWER SUPPLY NO. 20900/20920



ENERGY CONCEPTS, INC. ECI

676-4300

SPECIFICATIONS*

3INATION POWER SUPPLY NO. 20900/20920

'UT VOLTAGE:
VDC: (2) regulated, independently loaded, ıtinuously variable with coarse ust
) VDC: continuously iable
) VAC: continuously iable
VAC: fixed
'AC: fixed

PUT CURRENT:
'DC): (2) 0-1 amp
rrent shutdown
VDC: 0-100 mA
/AC: 0-1.8 amp
'6.3 VAC: 0-2 amp

E/LOAD REGULATION:
/DC): ±10 mV/±0.1%

ULATOR RESPONSE TIME:
llisecond

'LE NOISE:
than 3 mV RMS at any voltage

TECTION:
ary: internal fuse
ndary: (+25): current utdown
ndary: (+300): circuit eaker and fuse
ndary (130): circuit eaker
12.6/6.3 output: circuit eaker

ITROLS:
VDC: (2) coarse adjust
0-300 VDC coarse adjust
0-130 VAC coarse adjust

SWITCHES:
Power: pushbutton, alternate action
High Voltage: key-actuated
Range: (4) Pushbutton, alternate action, 0-10 VDC, 10-25 VDC

OUTPUT RECEPTACLES/CONNECTORS:
B + (0-25 VDC): 5-way binding post
Common: 5-way binding post
B + (0-300 VDC): 5-way binding post
Common: 5-way binding post
Line Ground: 5-way binding post
AC (0-130 VAC): 3-wire grounding type receptacle
6.3/12.6 VAC: two 5-way binding posts
6.3 VAC (common): 5-way binding post

INDICATORS:
1 — LED (red): power "on"
2 — LED 0-25 VDC: "flashing overload"

POWER REQUIREMENTS:
Line Voltage: 105-130 VAC @ 50/60 Hz
Power Consumption: 150 watts with VAC output unloaded
Power Cable: 3-wire grounding type

CASE:
Height: 8-1/8"
Width: 12-3/4"
Depth: 9-5/8"

WEIGHT:
In Case: 17 lbs.

*SPECIFICATIONS AND DESCRIPTIONS SUBJECT TO CHANGE WITHOUT NOTICE

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MAINTENANCE INFORMATION

ENERAL

ıe Energy Concepts Combination Power Supply is a precision instrument which, when used and maintained properly, will provide years of trouble-free operation. However, when service is required, the chassis ırts and circuit board components are easily accessible and clearly identified for convenience in trouble-ıooting.

15 minute warm-up period should be allowed before any adjustments are made. Figure 1-1 shows a mplified diagram of the Combination Power Supply.

> **NOTE**
> ONLY AUTHORIZED, QUALIFIED PERSONNEL SHOULD PERFORM ANY TROUBLESHOOTING, COMPONENT REPLACEMENT, ALIGNMENT, ETC., ON THIS INSTRUMENT.

ASE REMOVAL

1. Disconnect the AC power cable from the AC source, and remove all leads from the front panel.
2. Using a 9/64" allen wrench, remove the four allen-head cap screws from the end caps.
3. Lay the end caps to one side, and remove four 8-32 x 5/16" binder-head screws from beneath the case.
4. Slowly slide the chassis forward out of the case. It may be necessary to tilt the front panel up slightly in order to clear the case front.

NTERNAL FUSES

The Combination Power Supply is equipped with an internal line protection fuse. This fuse, located at the ıottom rear of the chassis, is a 2.0 A, slo-blow type, which protects the unit in the event of transformer ailure or severe line voltage variations.

A second fuse, 0.5 A slo-blow type, is also located at the bottom rear. This is in series with the 0.1 ampere ircuit breaker in the 0-300 VDC supply, offering additional protection for peak overloads which are aster than the response time capabilities of the circuit breaker.

CIRCUIT DESCRIPTION

Figure 1 is a simplified schematic of the Combination Power Supply.

Each 0-25 volt power supply is a series regulator with Q102 as the series pass element. Input voltage is stepped down, rectified, and filtered by T1, BR101, and C101 respectively. A fraction of the output voltage fed back to IC101 by R2 and R3 is compared with a reference voltage which is generated within IC101 (pin 6). The comparator output controls the series pass element, Q102 (a darlington pair), which determines output voltage. Output current will generate a voltage drop across R104. When this voltage is great enough, SCR101 will fire and bring the adjustable reference voltage down to ground, which will reduce output voltage to zero. D102 is the Overload Indicator and is on when SCR101 conducts. The transistor at pins 2 and 3 of IC101 is a back-up current limiter.

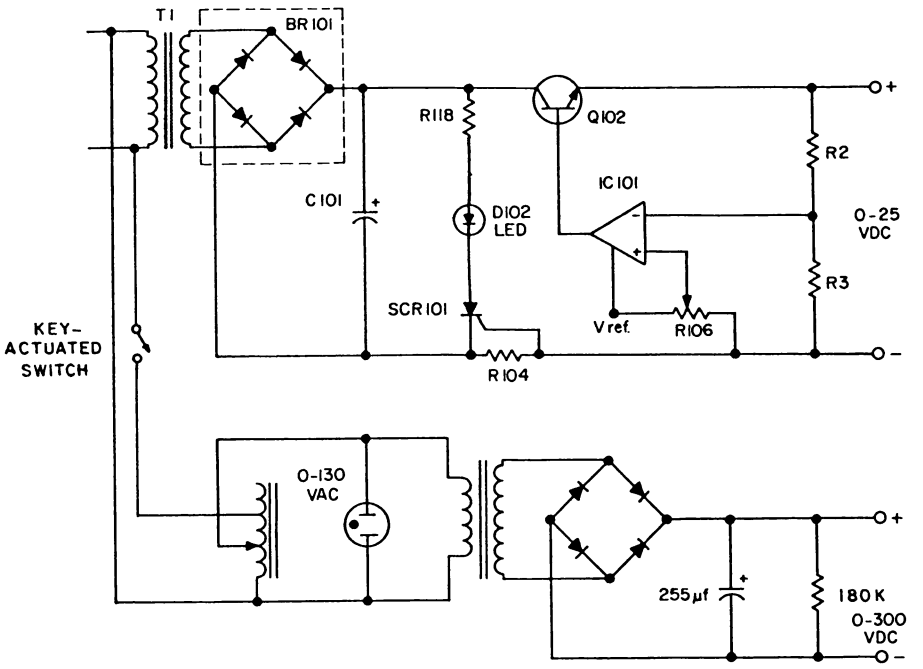


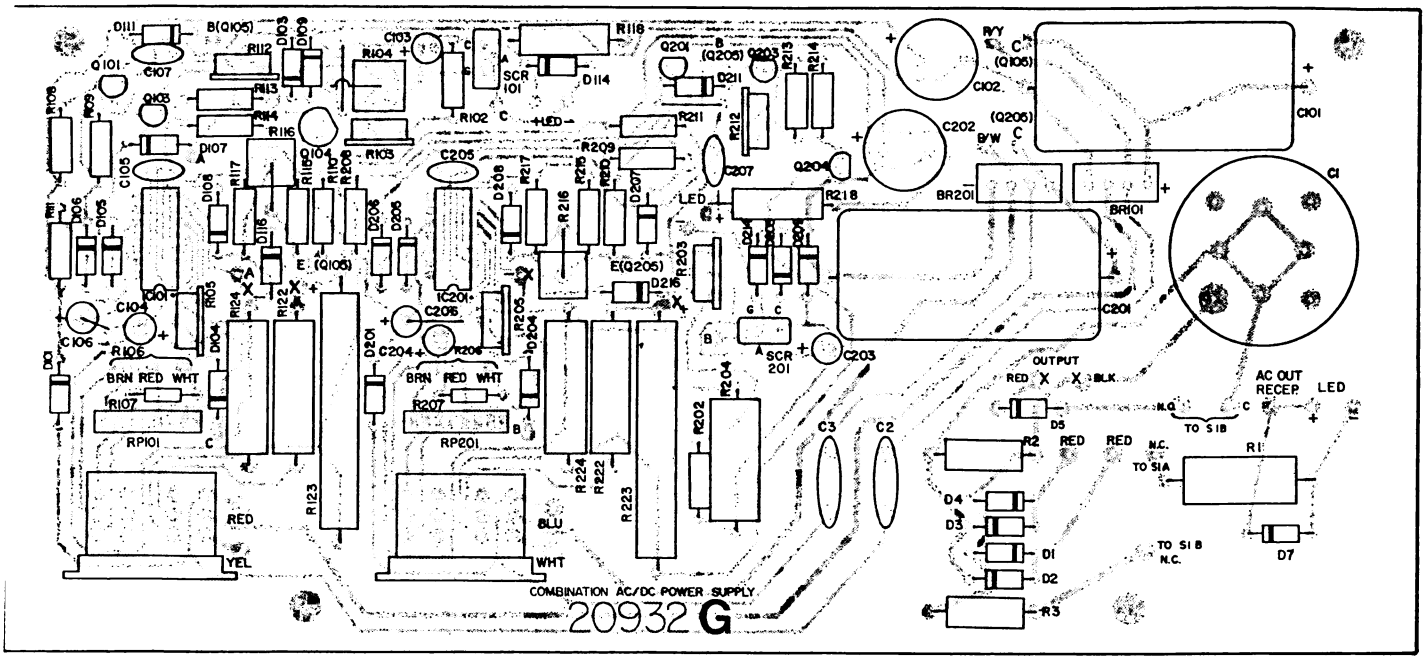
FIGURE 1, Simplified Schematic

0-300 VDC/0-130 VAC

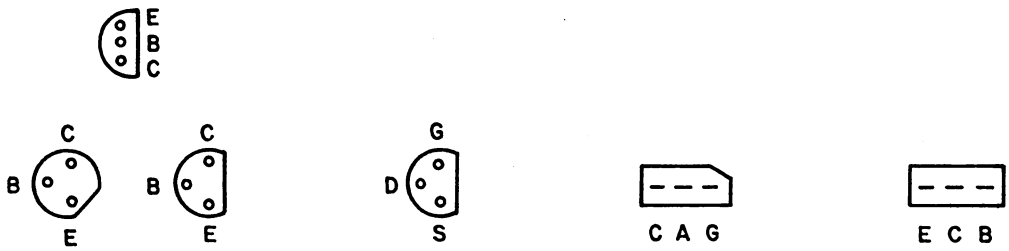
The 0-130 VAC output is obtained through an autotransformer. Its output voltage is stepped up, filtered, and rectified for the 0-300 VDC output. The key-actuated switch enhances operator safety by inhibiting unauthorized use of the high voltage supplies.

CIRCUIT BOARD COMPONENT IDENTIFICATION

The circuit board component mounting configuration is shown in Figure 2. In this illustration the components are shown from the top side of the board, and are identified by actual part and location.



TRANSISTOR BASING SHOWN FROM BOTTOM



2N3645 2N5952 C106A2 SCR TIP 120

FIGURE 2, Parts Layout

CALIBRATION PROCEDURE

GENERAL

This instrument has been factory calibrated to the specifications set forth in this manual. However, after a period of use the instrument may require recalibration as a result of component change or replacement.

Before attempting to calibrate this instrument, be sure the unit is operating properly, and that all malfunctions have been corrected. Refer to the Operation Information Manual to determine the operating condition of the power supply.

0-25 VDC

1. Remove the case as outlined in the CASE REMOVAL instructions and connect the AC power cable to a 117 volt 50/60 Hz AC source.

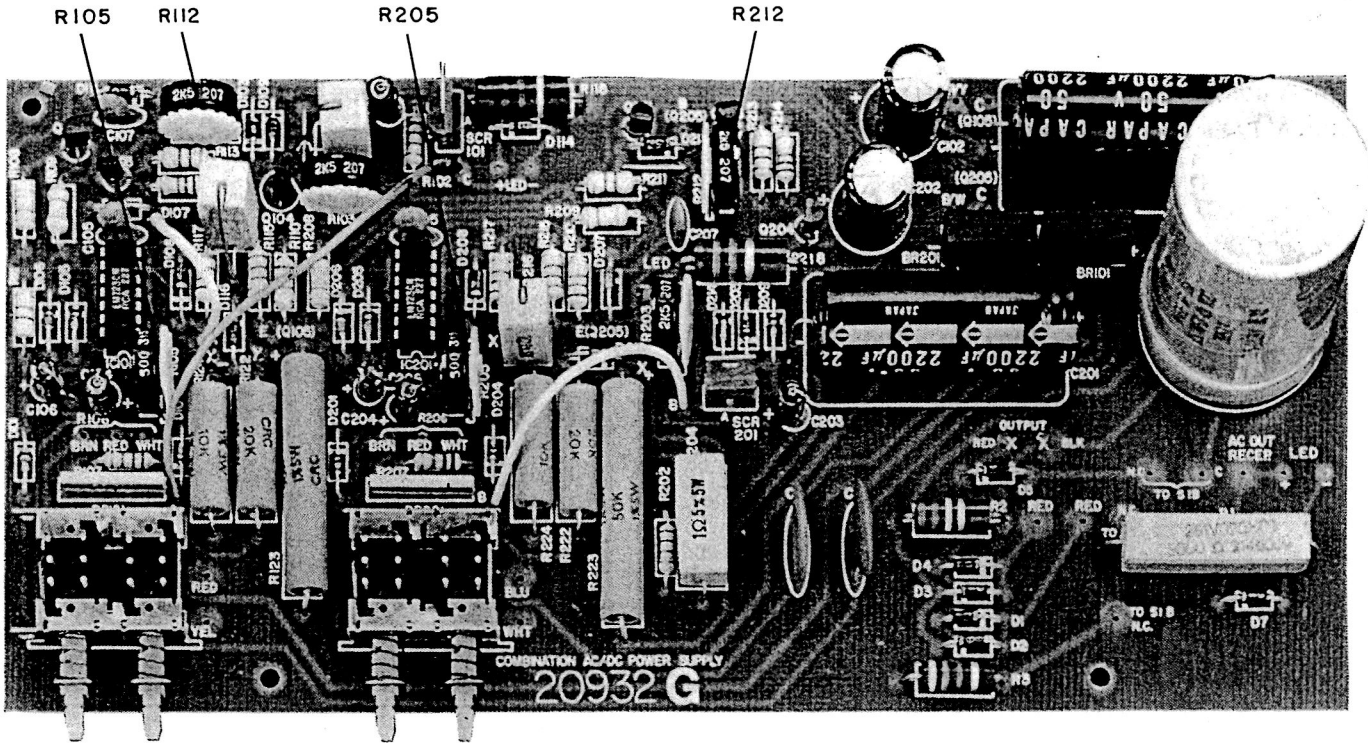


FIGURE 3, Adjustment Locations, Top View

2. Center all trimpots; refer to Figures 3 and 4.

3. Rotate the Voltage Adjust Control (Front Panel) fully counterclockwise and depress the 0-10 VDC Range Switch.

4. Adjust the minimum voltage trim pots R112 and R212 for between 0 to 0.05 volts output.

5. Rotate the Voltage Adjust Control fully clockwise and depress the 10-25 VDC Range Switch.

6. Adjust the Maximum Voltage trim pots R105 and R205 for a 27 volt output.

Check to see that no more than 10 volts is obtainable in the 0-10 volt range, and 25 volts in the 10-25 volt range. Also check for a minimum of no less than 10 volts in the 10-25 volt range. These conditions must be met. If not, repeat the calibration procedure.

CURRENT LIMIT

1. Depress the 10-25 VDC Range switches.
2. Adjust the output voltage for 10.5 VDC.
3. Rotate the current trimpots R103 and R203 in the direction indicated in Figure 4.
4. Connect a 10 ohm, 1%, 10 watt resistor across the output jacks of each 0-25 VDC power supply.
5. Rotate R103 slowly until the power supply just overloads.
6. Rotate R203 slowly until the power supply just overloads.

Upon completion of the calibration procedure, it is recommended that the steps in the Operation Information Manual be performed as a final check of the power supply calibration.

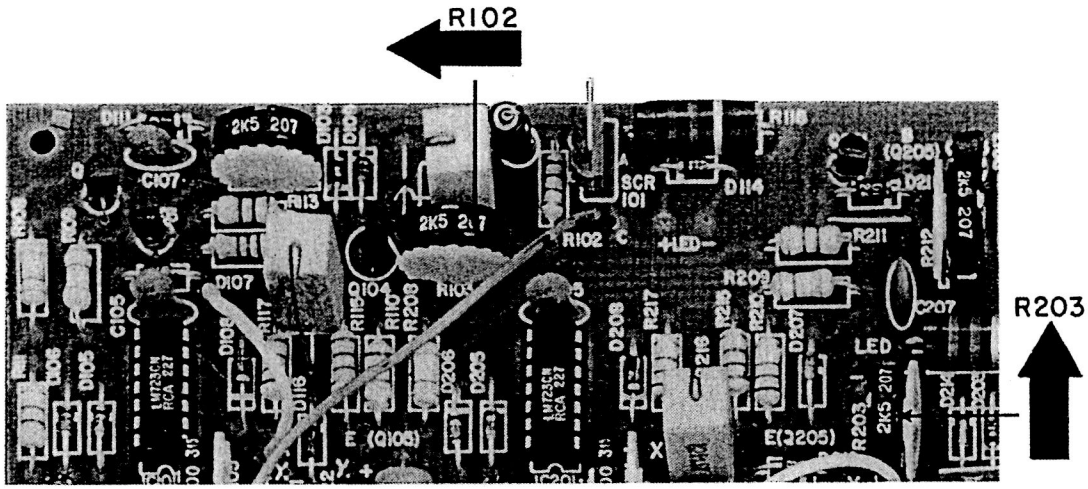


FIGURE 4, Adjustment Locations, Top View

NOTE

THE USER MUST CHECK ALL INTERNAL FUSES BEFORE SENDING UNIT IN FOR CALIBRATION OR WARRANTY REPAIR.

TROUBLESHOOTING HINTS

Locating a defective part or parts in the Combination AC/DC Power Supply can usually be accomplished by using a standard troubleshooting procedure.

NO OUTPUT AND AN UNCONTROLLABLE OUTPUT (0-25 VDC SUPPLY)

When there is no output, or an uncontrollable output, the μA723 regulator (IC101) is usually defective. This may be checked by substituting a known good μA723 regulator for the one that is thought to be defective. A visual check for burned parts should be made before switching the μA723 ICs. After switching the ICs, if the trouble is still present, transistors Q101, Q102, Q103, and Q104 should be checked for shorts.

NO REGULATION (0-25 VDC SUPPLY)

If the unit works properly until a load is applied, the problem is usually a leaky IC101, Q101, or Q102. To find this problem, voltage readings should be taken at each stage with a load applied to the supply and then with the load removed. The voltage should not vary between load and no-load conditions. A varying voltage will indicate the defective stage. Resistance measurement should then be taken to locate the defective part or parts.

DEFECTIVE TRIP CIRCUIT (0-25 VDC SUPPLY)

The most likely components to be defective in this circuit are resistors R102 and R104. If the resistors measure the proper values, then SCR101 is defective. Resistance checks should also be made on diode D109 for a leaky condition. Diode D115, a flashing LED, needs approximately 5 volts for proper operation.

0-300 VDC/0-130 VAC SUPPLIES

Problems in the 0-300 VDC supply and the 0-130 VAC supply are usually found to be a blown fuse or an open variac. A low DC voltage from the 0-300 VDC supply could be caused by a leaky diode in the bridge rectifier section, or capacitor C1 could be leaky. These problems can be found by taking resistance measurements.

The unit should be recalibrated after repairs have been completed.

SERVICE PARTS LIST

P.C. BOARD PARTS

SCHEMATIC REFERENCE NUMBER	PART NUMBER	COMPONENT DESCRIPTION
		ICs AND TRANSISTORS
Q101, Q104, Q201, Q204	20858	2N3645 Transistor
Q103, Q203	20818	2N5952 FET
IC101, IC201	30015	723 IC
IC102, IC202	not used	
Q105, Q205	20434	TIP640
		SCRs
SCR101, SCR201	21051	C106A1 SCR
		DIODES
D1, D2, D3, D4, D5, D7, D108, D111, D116, D208, D211, D216	15236	1N4006 Diode
D101, D103, D104, D105, D106 D109, D117, D201, D204, D205, D206, D209, D217	20108	1N4002 Diode
BR101, BR201	20111	Bridge Rectifier
		ZENER DIODES
D107, D207	29117	1N4744 Zener Diode
D114, D214	23014	1N4733 Zener Diode
		CAPACITORS
C1	39513	150 μF, 450V, Vert. Electrolytic
C4	not used	
C101, C201	20909	2200 μF, 50V, Axial Electrolytic
C102, C202	30058	250 μF, 50V, Vert. Electrolytic
C103, C104, C203, C204	39022	5 μF, 16V Axial Electrolytic
C106, C206	20911	1 μF, 50V, Axial Electrolytic
C105, C107, C205, C207	15298	0.001 μF, Disc
C109, C110, C209, C210	not used	
C2, C3	20631	0.1 μF, 500V Disc
		POTENTIOMETERS
R103, R112, R203, R212	39532	2.5 K Trimpot
R105, R205	30024	500 Ohm Trimpot

P.C. BOARD PARTS

SCHEMATIC REFERENCE NUMBER	PART NUMBER	COMPONENT DESCRIPTION
		RESISTORS
R2	35140	180 K, 1 W, 5%
R114, R214	20913	1.5 K, 0.5 W, 5%
R115, R215	15902	2.7 K, 0.5 W, 5%
R117, R217	15283	5.6 K, 0.5 W, 5%
R108, R109, R208, R209	30570	3.9 K, 0.5 W, 5%
R102, R107, R202, R207	15268	1 K, 0.5 W, 5%
R110, R210	15281	1.8 K, 0.5 W, 5%
R111, R211	30573	4.7 K, 0.5 W, 5%
R113, R213	30569	470 Ohm, 0.5 W, 5%
R104, R116, R204, R216	20910	1 Ohm, 5 W, 5%
R121, R221	not used	
R119, R219	not used	
R120, R220	not used	
R118, R218	33124	560 Ohm, 2 W, 10%
R123, R223	20924	50 K, 3 W, 1%
R122, R222	20923	20 K, 3 W, 1%
R124, R224	20925	10 K, 3 W, 1%
RP101, RP201	20812	Resistor Pack
R3	15246	4.7 K, 1 W, 10%
		MISCELLANEOUS
S101, S102, S201, S202	20904	Pushbutton Switch, 2 Station, 2 Pole
S2, S3	not used	
	40513	Switch Spacer
	20932G*	Circuit Board
	40027	14-Pin IC Socket

CHASSIS PARTS

		TRANSISTORS AND DIODES
Q102, Q202	not used	
D6, D113, D213	20428	MR 754 Diode
D8	21640	LED w/Hardware
D102, D202	not used	
D110, D210	not used	
D115, D215	22970	Flashing LED w/Hardware
		RESISTORS AND CAPACITORS
R1	38614	5 K Resistor, 5 W, 10%
R106, R206	40057	25 K Pot, PC Terminals
C108, C208	18094	0.1 μF Capacitor, 400 V

*All components listed pertain to the "G" revision printed circuit board.

SCHEMATIC REFERENCE NUMBER	PART NUMBER	COMPONENT DESCRIPTION
		MISCELLANEOUS
T1	20825	Transformer 151-K-49
T3	20930C	Transformer 151-K-47
T2	15105	1.75 Amp Variac
CB1, CB2	20926A	2 Amp Circuit Breaker
CB3	20934	1.8 Amp Circuit Breaker
CB4	20927A	100 mA Circuit Breaker
F1	29185	2 Amp Slo-Blo Fuse
F2	not used	
F3	not used	
S4	36766	Key Switch
	20903D	Chassis
	40510	Pushbutton (Blue)
	40511	Pushbutton (Red)
	16113	Binding Post (Black)
	16112	Binding Post (Red)
	16114	Binding Post (Green)
	16115	Binding Post (Yellow)
	36967	3-Wire AC Outlet
	20112	Fuse Mount
	20807B	Heat Sink
	20901B	Front Panel
	40508	Gray Knob (Small)
	20906	Gray Knob (Large)
	29020	Line Cord
	21031	Strain Relief Bushing
	21027	Heat Sink Bushing
	15160	Terminal Strip TB-T-T-T
	20815	Spacer - 1½" Long
	40512	Spacer
	5220	8-32 x 5/16" BHMS
	982	8-32 Nut
	797	No. 8 Lockwasher
	709	6-32 x ¼" BHMS
	10823	6-32 x ⅜" BHMS
	11268	6-32 x ½" BHMS
	816	6-32 x ½" RH
	698	#6 Solder Lug
	20940	Power Switch
	1190	6-32 Nut
	735	No. 6 Lockwasher
	4200	⅜ x 32 Nut
	20840	4-40 x ⅞" BHMS
	20119	4-40 Nut
	18087	No. 4 Lockwasher

MISCELLANEOUS (CONT'D.)

SCHEMATIC REFERENCE NUMBER	PART NUMBER	COMPONENT DESCRIPTION
	39512	Spacer 1¼"
	20721	Wire Ties
	21054	Shoulder Washer
	736	Lockwasher
	22333	#10 Solder Lug
CASE		
	16702A	Case
	16230	End Cap
	36407	Side Trim
	16239	8-32 x 1" Allen Head Cap Screw
	16237	Rubber Feet

WARRANTY

ENERGY CONCEPTS, INCORPORATED, warrants this equipment to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of this unit which under normal installation, use, and service discloses such defect, provided that the unit is delivered by the purchaser to the dealer from whom purchased, or to Energy Concepts, Incorporated, or to a stipulated agent, intact, for the purpose of examination within a period of two years from the date of sale to the original purchaser and provided such examination discloses in our judgment that it is defective.

This warranty does not apply if the equipment has been subjected to misuse, neglect, improper installation, used in violation of instructions provided by us, or if repaired or in any way altered outside of our factory or authorized service facility, or if the serial number has been removed, defaced or changed.

Any part approved for remedy or exchange hereunder will be remedied or exchanged without charge to the owner.

Energy Concepts, Inc., assumes no liability for injury, damage, or expense claimed to have been incurred through the use or in the installation of our equipment and products.

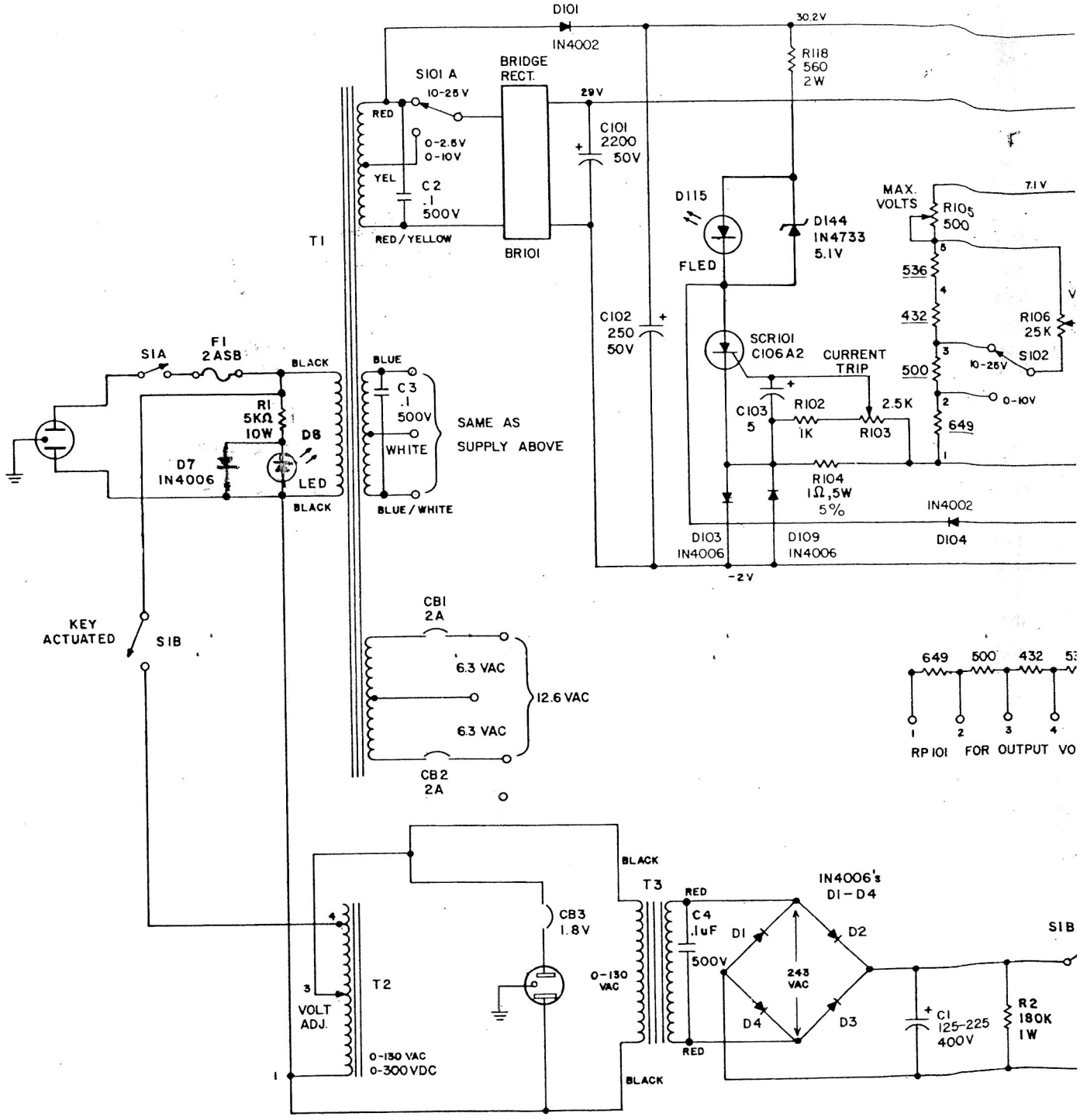
This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of this equipment.

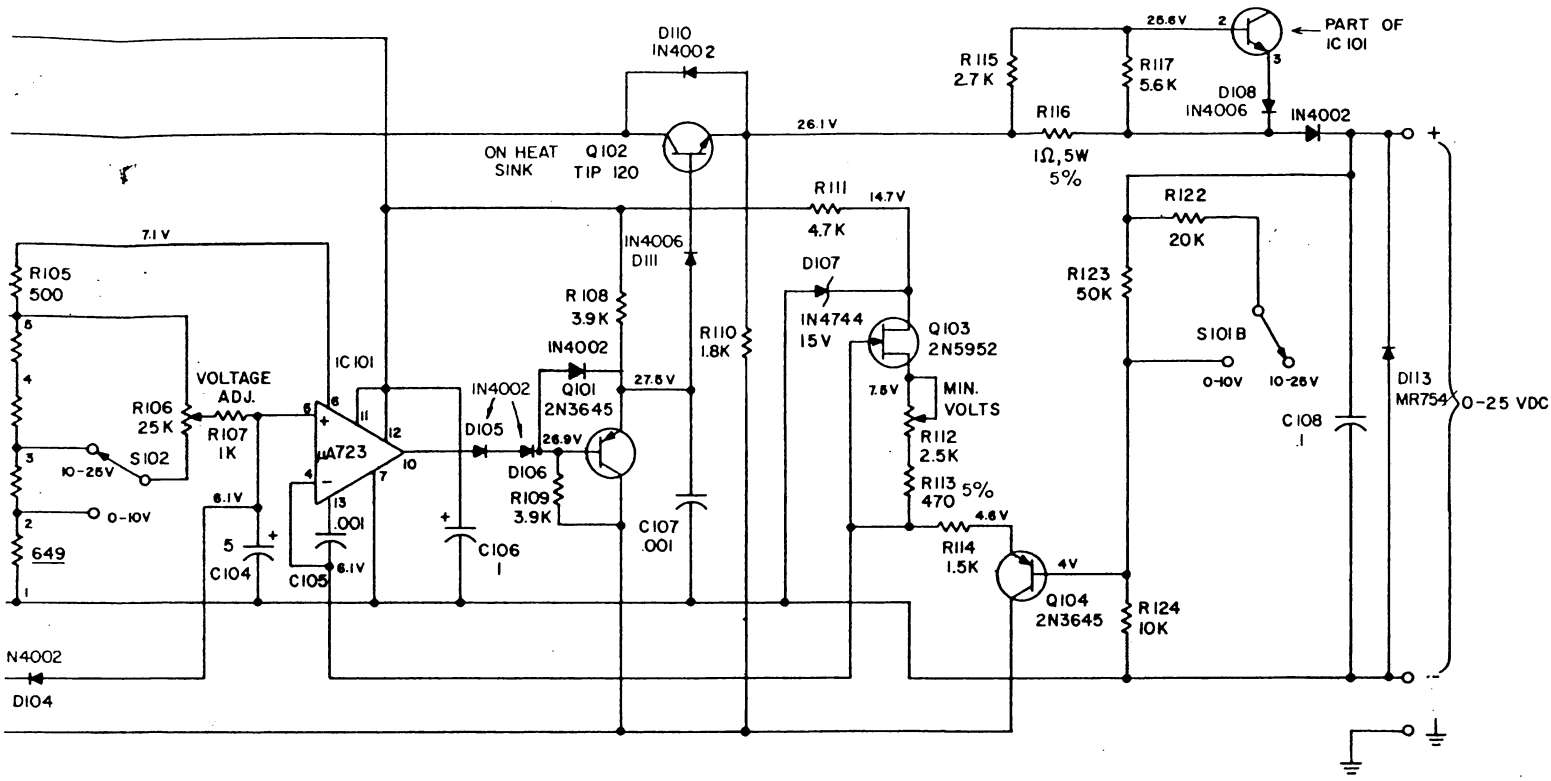
Further information can be obtained from:

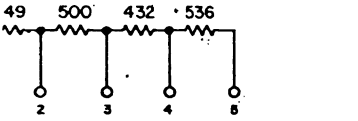
Energy Concepts, Inc.
~~3254 N. Kilbourn Avenue~~
~~Chicago, Illinois 60641~~

7440 N. Long Ave
Skokie
60077

SCHEMATIC


D101
IN4002
30.2V
R118
560
2W
S101 A
10-25 V
BRIDGE
RECT.
29V
C101
2200
50V
RED
0-2.5V
0-10V
YEL
C2
.1
500V
RED/YELLOW
T1
BR101
D115
FLED
D144
IN4733
5.1V
MAX.
VOLTS
7.1V
R105
500
536
432
500
649
R106
25K
S102
10-25V
0-10V
C102
250
50V
SCR101
C106A2
CURRENT
TRIP
C103
5
R102
1K
R103
2.5K
R104
1Ω,5W
5%
D103
IN4006
D109
IN4006
IN4002
D104
-2V
S1A
F1
2ASB
BLACK
R1
5KΩ
10W
D8
LED
D7
IN4006
BLACK
BLUE
C3
.1
500V
WHITE
BLUE/WHITE
SAME AS
SUPPLY ABOVE
KEY
ACTUATED
S1B
CB1
2A
6.3 VAC
6.3 VAC
12.6 VAC
CB2
2A
649
500
432
RP101 FOR OUTPUT VO
BLACK
T3
RED
C4
.1uF
500V
IN4006's
D1-D4
D1
D2
D3
D4
243
VAC
RED
BLACK
CB3
1.8V
0-130
VAC
T2
VOLT
ADJ.
0-130 VAC
0-300VDC
C1
125-225
400V
R2
180K
1W
S1B





101 FOR OUTPUT VOLTAGE SWITCHING

NOTES:

UNDERLINED RESISTORS ARE 0.1W, 1% AND ARE CONTAINED IN RP101.

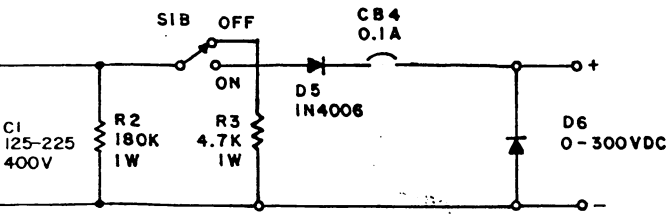
ALL RESISTORS ARE IN OHMS AND ARE 10% UNLESS OTHERWISE NOTED.

ALL CAPACITORS ARE IN MICROFARADS.

SECOND POWER SUPPLY IDENTICAL, ADD 100 TO IDENTIFICATION LABELS.

RANGE SWITCHES SHOWN IN 10-25V POSITION.

ALL VOLTAGES ARE REFERENCED TO -TERMINAL AND MEASURED WITH 25V OUTPUT AND 1A LOAD.



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